

**REMARKS**

Claims 1, 8, 9, 13, 14, 18, and 19 have been amended. Claims 1 through 20 remain in the application.

**The Drawings**

The drawings were objected to because FIG. 3A of drawings allegedly omits the advancement of the methodology to circle “D” at reference identified 135. Applicants respectfully traverse this objection.

Attached to this Amendment is a copy of the drawing for FIG. 3A with corrections in red to add the circle “D” for the Examiner’s approval. It is respectfully submitted that the drawings overcome the objection.

**The Abstract of the Disclosure**

The Abstract of the Disclosure was objected to because it does not appear to indicate the conditions that determine the detection of the collision between the models. Applicants respectfully traverse this objection.

Under 37 C.F.R. 1.72, the Abstract of the Disclosure should be such to enable the reader to determine quickly from a cursory inspection the nature and gist of the technical disclosure. The Abstract of the Disclosure lists the steps of the method to allow the reader to determine quickly from a cursory inspection the nature and gist of the method. Applicants are not required to indicate the conditions that determine the detection of the collision between the models in the Abstract of the Disclosure. These conditions are described in the specification. The Examiner has not cited any authority for his position that Applicants need to indicate the conditions that determine the detection of the collision between the models in the Abstract of the

Disclosure. As such, the Abstract of the Disclosure is acceptable. Therefore, it is respectfully submitted that the Abstract of the Disclosure overcomes the objection.

### **The Claims**

Claims 9 and 14 were objected to under 37 CFR § 1.75(a) because line 14 of claim 9 and line 15 of claim 14 use the term “triangle.” Additionally, the text of claim 14 does not appear to terminate with a period. Applicants respectfully traverse these objections.

Claims 9 and 14 have been amended as suggested by the Examiner on page 3 of the Office Action. It is respectfully submitted that claims 9 and 14 are allowable over the objections.

### **35 U.S.C. § 112**

Claims 1 through 8 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Claims 1 through 20 were rejected under 35 U.S.C. § 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. Applicants respectfully traverse both rejections.

Claim 1 has been amended to specify a first geometric model and a second geometric model. Claims 1 through 8 define the relationship between the preamble and the body of the claims. As such, claims 1 through 8 are definite. As to claims 1 through 20, claims 1, 9, and 14 have been amended to clarify when a collision is detected. Claims 1 through 20 do not omit essential steps because the relationship between the preamble and the body of the claims is defined. As such, claims 1 through 20 are definite. Therefore, it is respectfully submitted that claims 1 through 20 are allowable over the rejections under 35 U.S.C. § 112, second paragraph.

**35 U.S.C. § 101**

Claims 1 through 7 and 9 through 12 were rejected under 35 U.S.C. § 101 because the disclosed invention is allegedly directed to a process comprising an abstract idea and therefore lacks utility. Applicants respectfully traverse this rejection.

As to inventions patentable, 35 U.S.C. § 101 provides that:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The plain and unambiguous meaning of Section 101 is that any invention falling within one of the four stated categories of statutory subject matter may be patented, provided it meets the other requirements for patentability set forth in Title 35.

Claims 1 and 9 claim a method or process of real time collision detection between geometric models. While the method may involve a computer, it is still statutory subject matter. As such, the method is useful and is one of the statutory categories of patentable subject matter. The method of the present invention therefore has utility. Contrary to the Examiner's opinion, the method has utility and the Examiner is incorrect that it lacks utility. Further, Applicants have amended claims 1 and 9 to clarify when a collision is detected to produce a practical application. In addition, claims 1 and 9 have been amended to recite the steps of providing a force feedback device and computer system. As such, claims 1 through 7 and 9 through 12 require a computer system and are not an abstract idea. Therefore, it is respectfully submitted that claims 1 through 7 and 9 through 12 are allowable over the rejection under 35 U.S.C. § 101.

**35 U.S.C. § 102**

Claims 1 through 8 were rejected under 35 U.S.C. § 102(e) as being anticipated by Basdogan et al. (U.S. Patent No. 6,704,694). Applicants respectfully traverse this rejection.

U.S. Patent No. 6,704,694 to Basdogan et al. discloses a ray based interaction system. Real time simulation phase processing begins and processing then flows from block 92 to processing block 94 where position and orientation information of the ray-based probe is retrieved from a haptic device. Processing then flows to decision block 96 where decision is made as to whether any portion of the ray-based probe has collided with and any portion of any object. If a collision is detected, then processing flows to processing block 98 where an appropriate response is provided to a user. If no collision is detected, then processing returns to block 94. Thus steps 94 and 96 implement a loop which is repeated until a collision is detected. After a collision is detected, processing proceeds to step 98b where collision processing is performed and then to step 100 where an appropriate collision response is provided to a user. Basdogan et al. does not disclose determining a contact force between the first geometric model and the second geometric model and concluding a collision between the first geometric model and the second geometric model if the contact force is greater than zero.

In contradistinction, claim 1, as amended, clarifies the invention claimed as a method of real time collision detection between geometric models including the steps of providing a force feedback device and providing a computer system operatively connected to the force feedback device. The method also includes the steps of identifying a current tracking point of the force feedback device representing a first geometric model colliding with a mesh model of a second geometric model and identifying a current triangle associated with the current tracking point. The method includes the steps of determining a new tracking point of the force feedback device relative to the mesh model by approximating the new tracking point from the current

tracking point and the current triangle and determining a state of the new tracking point using the new tracking point and the state of the previous tracking point, wherein the state is inside, on an edge or on a vertex of either the current triangle or a new triangle. The method further includes the steps of using the state of the new tracking point to determine if a predetermined condition is met to conclude that the new tracking point is on the current triangle or if another predetermined condition is met to conclude that the new tracking point crossed to a new triangle, wherein the new triangle is connectively associated with the current triangle. The method also includes the steps of determining a contact force between the first geometric model and the second geometric model and concluding a collision between the first geometric model and the second geometric model if the contact force is greater than zero.

A rejection grounded on anticipation under 35 U.S.C. § 102 is proper only where the subject matter claimed is identically disclosed or described in a reference. In other words, anticipation requires the presence of a single prior art reference which discloses each and every element of the claimed invention arranged as in the claim. In re Arkley, 455 F.2d 586, 172 U.S.P.Q. 524 (C.C.P.A. 1972); Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 218 U.S.P.Q. 781 (Fed. Cir. 1983); Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co., 730 F.2d 1452, 221 U.S.P.Q. 481 (Fed. Cir. 1984).

None of the references cited disclose or anticipate the claimed invention of claim 1. Specifically, Basdogan et al. '694 merely discloses a ray based interaction system in which position and orientation information of a ray-based probe is retrieved from a haptic device and a decision is made as to whether any portion of the ray-based probe has collided with and any portion of any object. Basdogan et al. '694 lacks determining a contact force between a first geometric model and a second geometric model and concluding a collision between the first geometric model and the second geometric model if the contact force is greater than zero.

Basdogan et al. '694 fails to disclose the combination of a method of real time collision detection between geometric models including the steps of providing a force feedback device, providing a computer system operatively connected to the force feedback device, identifying a current tracking point of the force feedback device representing a first geometric model colliding with a mesh model of a second geometric model and identifying a current triangle associated with the current tracking point, determining a new tracking point of the force feedback device relative to the mesh model by approximating the new tracking point from the current tracking point and the current triangle, determining a state of the new tracking point using the new tracking point and the state of the previous tracking point, wherein the state is inside, on an edge or on a vertex of either the current triangle or a new triangle, using the state of the new tracking point to determine if a predetermined condition is met to conclude that the new tracking point is on the current triangle or if another predetermined condition is met to conclude that the new tracking point crossed to a new triangle, wherein the new triangle is connectively associated with the current triangle, determining a contact force between the first geometric model and the second geometric model, and concluding a collision between the first geometric model and the second geometric model if the contact force is greater than zero as claimed by Applicants. Therefore, it is respectfully submitted that claim 1 and the claims dependent therefrom are allowable over the rejection under 35 U.S.C. § 102(e).

### **35 U.S.C. § 103**

Claims 9 through 20 were rejected under 35 U.S.C. § 103 as being unpatentable over Basdogan et al. '694 in view of common knowledge regarding initialization of computer simulations. Applicants respectfully traverse this rejection.

In contradistinction, claim 9, as amended, clarifies the invention claimed as a method of real time collision detection with a geometric model of a vehicle. The method includes the steps of providing a force feedback device and providing a computer system operatively connected to the force feedback device. The method also includes the steps of identifying a current tracking point of the force feedback device representing a point of an object colliding with a mesh model of the vehicle and identifying a current triangle associated with the current tracking point. The method also includes the steps of determining a new tracking point of the force feedback device relative to the mesh model by projecting the current tracking point onto a plane defined by the current triangle. The method includes the steps of determining a state of the new tracking point relative to the current triangle or a new triangle by finding an intersection between a vector connecting the previous tracking point and the current tracking point with an edge of the current triangle, and using the intersection to determine the state of the new tracking point, wherein the state is inside, on an edge or on a vertex of either the current triangle or a new triangle. The method further includes the steps of using the state of the new tracking point to determine if a predetermined condition is met to concluding the new tracking point is on the current triangle or if another predetermined condition is met to concluding the new tracking point is crossing over to a new triangle, wherein the new triangle is connectively associated with the current triangle. The method also includes the steps of determining a contact force between the new tracking point and the mesh model and concluding a collision between the object and the geometric model if the contact force is greater than zero. Claim 14 has been amended similar to claim 9 and includes other features of the present invention.

The United States Court of Appeals for the Federal Circuit (CAFC) has stated in determining the propriety of a rejection under 35 U.S.C. § 103(a), it is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art

absent some teaching, suggestion or incentive supporting the combination. See In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). The law followed by our court of review and the Board of Patent Appeals and Interferences is that “ [a] prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art.” In re Rinehart, 531 F.2d 1048, 1051, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976). See also In re Lahu, 747 F.2d 703, 705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984) (“In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification.”)

As to the differences between the prior art and the claims at issue, Basdogan et al. ‘694 merely discloses a ray based interaction system in which position and orientation information of a ray-based probe is retrieved from a haptic device and a decision is made as to whether any portion of the ray-based probe has collided with and any portion of any object. Basdogan et al. ‘694 lacks determining a contact force between a new tracking point and a mesh model and concluding a collision between an object and a geometric model if the contact force is greater than zero. There is no suggestion or motivation in the art to modify Basdogan et al. ‘694.

There is absolutely no teaching of a level of skill in the virtual reality art that a method of real time collision detection with a geometric model of a vehicle including the steps of determining a contact force between a new tracking point and a mesh model and concluding a collision between an object and the geometric model if the contact force is greater than zero. The Examiner may not, because he doubts that the invention is patentable, resort to speculation,



unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See In re Warner, 379 F. 2d 1011, 154 U.S.P.Q. 173 (C.C.P.A. 1967). While Basdogan et al. '694 teaches determining whether any portion of a ray-based probe has collided with and any portion of any object, Basdogan et al. '694 does not teach or suggest that a method of real time collision detection with a geometric model of a vehicle includes the steps of determining a contact force between a new tracking point and a mesh model and concluding a collision between an object and the geometric model if the contact force is greater than zero. Thus, none of the references teaches a level of skill in the virtual reality art that can be constructed as determining a contact force between a new tracking point and a mesh model and concluding a collision between an object and the geometric model if the contact force is greater than zero.

The present invention sets forth a unique and non-obvious combination of a method of real-time collision detection between geometric models that detects a collision between a point and a tessellated mesh of the model. Basdogan et al. '694, if modifiable, fails to teach or suggest the combination of a method of real time collision detection with a geometric model of a vehicle including the steps of providing a force feedback device, providing a computer system operatively connected to the force feedback device, identifying a current tracking point of the force feedback device representing a point of an object colliding with a mesh model of the vehicle and identifying a current triangle associated with the current tracking point, determining a new tracking point of the force feedback device relative to the mesh model by projecting the current tracking point onto a plane defined by the current triangle, determining a state of the new tracking point relative to the current triangle or a new triangle by finding an intersection between a vector connecting the previous tracking point and the current tracking point with an edge of the current triangle, using the intersection to determine the state of the new tracking point, wherein the state is inside, on an edge or on a vertex of either the current triangle

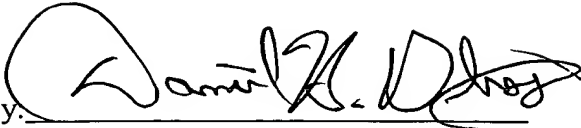
or a new triangle, using the state of the new tracking point to determine if a predetermined condition is met concluding the new tracking point is on the current triangle or if another predetermined condition is met to concluding the new tracking point is crossing over to a new triangle, wherein the new triangle is connectively associated with the current triangle, determining a contact force between the new tracking point and the mesh model, and concluding a collision between the object and the geometric model if the contact force is greater than zero as claimed by Applicants.

Further, the CAFC has held that “[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification”. In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicants’ invention. Thus, the Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claims 9 and 14 and the claims dependent therefrom are allowable over the rejection under 35 U.S.C. § 103.

Obviousness under § 103 is a legal conclusion based on factual evidence (In re Fine, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis, which is supportive of his/her position (see In re Warner, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), cert. denied, 389 U.S. 1057 (1968)), the rejection of claims 9 through 20 is improper. Therefore, it is respectfully submitted that claims 9 through 20 are allowable over the rejection under 35 U.S.C. § 103.

Based on the above, it is respectfully submitted that the claims are in a condition for allowance, which allowance is solicited.

Respectfully submitted,

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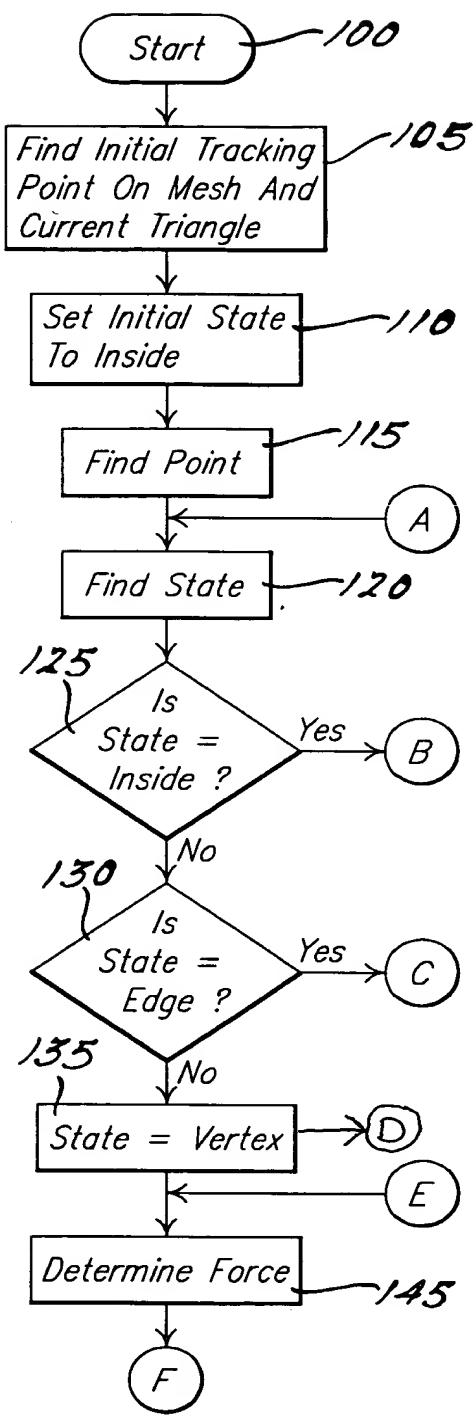


FIG. 1A.

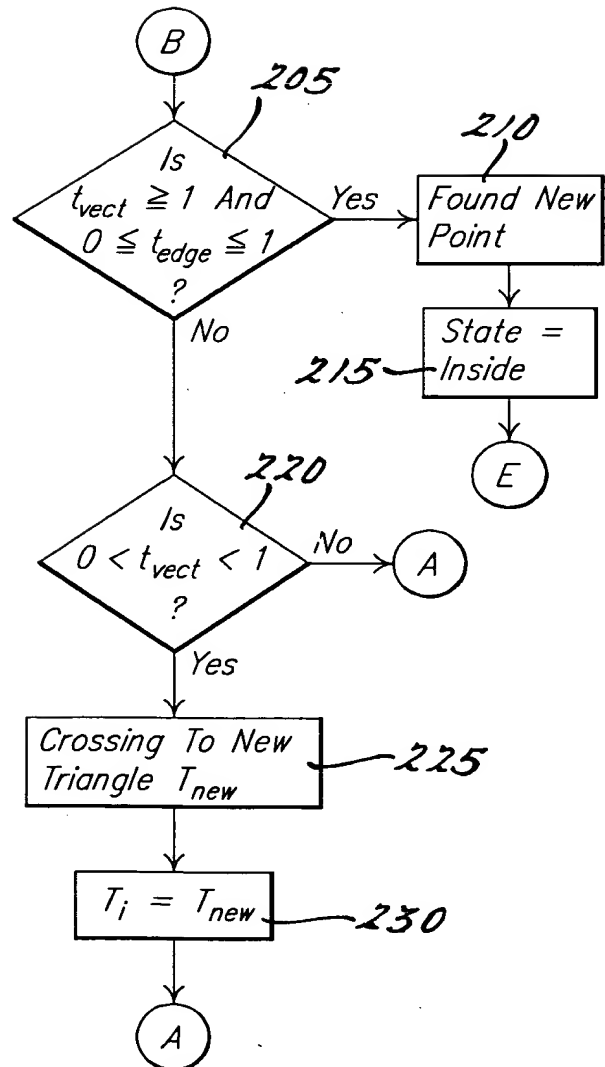


FIG. 1B.